What is claimed is:

1.   A method of manufacturing a heat exchanger comprising:

(a)   forming one or more filaments including a first composition encased in a second composition;

(b)   mechanically processing the one or more filaments to arrange the one or more filaments in a predetermined orientation to provide a green body;

(c)   subjecting the green body to conditions effective for removing the first composition from the one or more filaments and for sintering the second composition to provide a heat exchanger, wherein the heat exchanger includes one or more channels having walls made of the sintered second composition for containing coolant flow.

2.   The method of claim 1 wherein the one or more filaments are mechanically processed by extruding the one or more filaments and depositing the filaments onto a working surface in one or more layers.

3.   The method of claim 1 wherein the first composition is a composition that is soluble in at least one solvent and wherein the first composition is removed from the green body by contacting the green body with the solvent.

4.   The method of claim 3 wherein the solvent is water.

5.   The method of claim 1 wherein the first composition is a thermally degradable composition and wherein the first composition is removed from the green body by heating to a temperature and for a time effective for removing the first composition.

6.   The method of claim 1 wherein the second composition is selected from the group consisting of ceramic oxides, ceramic carbides, ceramic nitrides, ceramic borides, ceramic silicides, metals, and intermetallics, and combinations thereof.

7.   The method of claim 6 wherein the second composition is silicon carbide.

8.   The method of claim 1 wherein the second composition includes a material effective for enhancing the thermal conductivity of the heat exchanger.

9.   The method of claim 8 wherein the material is a nano additive selected from the group consisting of carbon black, carbon additive, silicon carbide, carbon nanotubes and nano fibers.

10.   The method of claim 8 wherein the nano additive is present in an amount of between about two to about five weight percent based on the weight of the second composition.

11.   The method of claim 1 wherein the method includes depositing a thin layer of a material on an outer surface of the heat exchanger to enhance the thermal conductivity of the heat exchanger.

12.   The method of claim 11 wherein the layer of material is deposited by a chemical vapor deposition process.

13.   The method of claim 1 wherein the method includes depositing a metallic layer onto a surface of the heat exchanger by a metallization process.

14.   The method of claim 1 wherein the method includes integrally forming one or more external protrusions on the green body.

15.   A heat dissipating device comprising an extruded body of a material selected from the group consisting of ceramic oxides, ceramic carbides, ceramic nitrides, ceramic borides, ceramic silicides, metals, and intermetallics, and combinations thereof, that includes one or more layers of channels for coolant flow therethrough, the channels having inner diameters of between about 50 microns to about 2000 microns.

16.   The heat dissipating device of claim 15 wherein the extruded body material is silicon carbide.

17.   The heat dissipating device of claim 15 wherein the inner diameters of the channels are between about 50 to about 100 microns.

18.   The heat dissipating device of claim 15 wherein the channels are arranged in the same direction.

19.   The heat dissipating device of claim 15 wherein the device includes two or more layers of channels and at least two adjacent layers are arranged at 90° to one another to provide multi-directional flow of coolant in the channels.

20.   The heat dissipating device of claim 15 wherein the channels are curved.

21.   The heat dissipating device of claim 15 further including one or more integrally-formed protrusions.

22.   The heat dissipating device of claim 21 wherein the protrusions are fins.

23.   The heat dissipating device of claim 15 further including an additional layer of a thermal conductivity-enhancing material on at least one outer surface of the device.

24.   The heat dissipating device of claim 15 further including an additional layer of a metallic material for imparting electronic circuitry characteristics to the device.

25.   A method of determining optimal sizing characteristics of a microchannel heat exchanger having one or more layers of channels by applying the formulas:

$$R = \frac{T_s - T_{f,in}}{q}$$

$$R_{base} = \frac{h}{k_s(\frac{w}{2}+\frac{b}{2})L}$$

$$R_{fin} = \frac{a}{k_s\frac{w}{2}L}$$

$$R_{base,conv} = \frac{1}{\bar{h}\frac{b}{2}L}$$

$$R_{fin,conv} = \frac{1}{\bar{h}aL}$$

$$R_{fluid} = \frac{1}{\dot{m}c_p}$$

$$R_{eq,1} = \frac{R_{base}}{2} + [\frac{R_{base,conv}}{2} \| R_{fin,conv}] + R_{fluid}$$

$$x \| y = \frac{x \cdot y}{x + y}$$

$$R_{eq,2} = R_{base} + [R_{base,conv} \| (R_{fin} + (R_{fin,conv} \| R_{base,conv}))] + R_{fluid}$$

$$R_a = \frac{R_{fluid}(R_{fin,conv} \| R_{base,conv})}{R_{eq,n-1} + (R_{fin,conv} \| R_{base,conv}) + R_{fluid}}$$

$$R_b = \frac{R_{eq,n-1}R_{fluid}}{R_{eq,n-1} + (R_{fin,conv} \| R_{base,conv}) + R_{fluid}}$$

$$R_c = \frac{R_{eq,n-1}(R_{fin,conv} \| R_{base,conv})}{R_{eq,n-1} + (R_{fin,conv} \| R_{base,conv}) + R_{fluid}}$$

$$R_{eq,n} = R_b + [(R_c + R_{fin}) \| (R_a + R_{base,conv})] + R_{base}$$

26.   An article of manufacture comprising an extruded body including one or more rows of microchannels, the body including a material selected from the group consisting of ceramic oxides, ceramic carbides, ceramic nitrides, ceramic borides, ceramic silicides, metals, and intermetallics, and combinations thereof, the size and number of layers of the channels being optimized using the formulas:

$$R = \frac{T_s - T_{f,in}}{q}$$

$$R_{base} = \frac{h}{k_s(\frac{w}{2} + \frac{b}{2})L}$$

$$R_{fin} = \frac{a}{k_s \frac{w}{2} L}$$

$$R_{base,conv} = \frac{1}{\bar{h} \frac{b}{2} L}$$

$$R_{fin,conv} = \frac{1}{\bar{h} a L}$$

$$R_{fluid} = \frac{1}{\dot{m} c_p}$$

$$R_{eq,1} = \frac{R_{base}}{2} + [\frac{R_{base,conv}}{2} \| R_{fin,conv}] + R_{fluid}$$

$$x \parallel y = \frac{x \cdot y}{x + y}$$

$$R_{eq,2} = R_{base} + [R_{base,conv} \parallel (R_{fin} + (R_{fin,conv} \parallel R_{base,conv}))] + R_{fluid}$$

$$R_a = \frac{R_{fluid}(R_{fin,conv} \parallel R_{base,conv})}{R_{eq,n-1} + (R_{fin,conv} \parallel R_{base,conv}) + R_{fluid}}$$

$$R_b = \frac{R_{eq,n-1} R_{fluid}}{R_{eq,n-1} + (R_{fin,conv} \parallel R_{base,conv}) + R_{fluid}}$$

$$R_c = \frac{R_{eq,n-1}(R_{fin,conv} \parallel R_{base,conv})}{R_{eq,n-1} + (R_{fin,conv} \parallel R_{base,conv}) + R_{fluid}}$$

$$R_{eq,n} = R_b + [(R_c + R_{fin}) \parallel (R_a + R_{base,conv})] + R_{base}$$